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(54) Individual section glass forming machine.

(57) The displacement of one or more of the plungers in an individual section glass forming machine is monitored so that the location of the plungers, when each mould cavity has completely filled (parison formation point), can be determined. When a plunger is located at the parison formation point the feed pressure is reduced by a selectable amount.

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position by cutting the feed pressure and applying a retract pressure and then retracted from the intermediate position to the out-of-the-way position to allow for removal of the parison.

The plunger mechanism also has a cylinder 30, a piston 32 movable in the cylinder 30, and a piston rod 34 projecting from the piston 32 through a seal 36 in an upper end cap 38 of the cylinder 30. The plunger 20 is mounted on an upper end portion of the piston rod 34 by a clamping ring 40. Pressurized hydraulic fluid introduced into the cylinder 30 through an upper entry port 42 causes the piston 32 to move downwards in the cylinder 30, and the introduction of the fluid through port 44 causes the piston 32 to move upwardly in the cylinder 30.

Each parison mould assembly also has a Control Valve which can alternately apply pressure to the appropriate cylinder ports 42, 44. The condition of the Control Valve (whether pressure is to be inputted via port 42 (plunger down) or port 44 (plunger up)) is controlled by a Plunger Controller (the system is illustrated with the Control Valve in the plunger up condition). The Control Valve is connected to pump P via a Pressure Setting Mechanism (a restrictor operated by a servo mechanism, for example), and the system is illustrated as the plunger is being advanced from the intermediate to the operative position with the Plunger Controller defining the desired feed pressure P1 for the Pressure Setting Mechanism.

It is within the last 3/8" of plunger stroke that the mould cavity becomes completely filled in the parison forming process. To track the displacement of each plunger throughout this portion of the stroke, each Parison Mould Assembly includes a displacement probe assembly having a linear potentiometer 50 secured to the cylinder 30. As a plunger is displaced through this 3/8", the piston 32 of that plunger will engage and displace a probe 52 to which is secured a potentiometer wiper 54. The displacement of this wiper 54 along an element 56 of the potentiometer changes the output of the linear potentiometer.

Figure 3 illustrates a plot of plunger displacement (voltage), as sensed by the probe, versus time, zero seconds being when the Plunger Controller commences plunger displacement (fires "plunger-up" solenoid, for example). This plot reveals a linear or constant velocity region between points A and B. Since the pressure is constant during this plunger advancement, the force exerted on the glass by the plunger remains constant. It is believed that point A is the point where the mould cavity has completely filled (the parison formation point) and that from point A to point B, the glass is cooling, and hence, shrinking. Point B corresponds to the time when the Plunger Controller commences plunger retraction (fires "plunger-down" solenoid, for example).

The Parison Formation Point Determiner for each plunger, which receives positional data from its associated displacement probe assembly determines when Point A has been reached (has determined that the displacement curve has become linear), and defines a new pressure setting (X%P1) to the Pressure Setting Mechanism. This drops the pressure applied by the plunger, thereby preventing the undesired opening of the moulds prior to Point B. A thumb wheel switch or the like 60 may be used to input the value of "X" which could be 70, for example.

Claims

1. An individual section glass forming machine comprising

at least one parison mould assembly (10) including a plunger (20) displaceable from a retracted position to a fully inserted position,

means (Plunger Controller, Control Valve) for displacing said plunger from said retracted to said fully inserted position, said plunger advancing to a parison formation point where the mould cavity has become completely full and then to the fully inserted position as the formed parison cools,

said displacing means including means (Pressure Setting Mechanism) for applying a selected pressure to said plunger as said plunger approaches said parison formation point,

means (50) for sensing the actual position of said plunger (20) throughout at least the last portion of its displacement which includes the parison formation point,

computer means (Parison Formation Point Determiner) for determining when the displacement curve for said plunger, during said portion of its displacement becomes linear to locate the actual parison formation point for said plunger, and

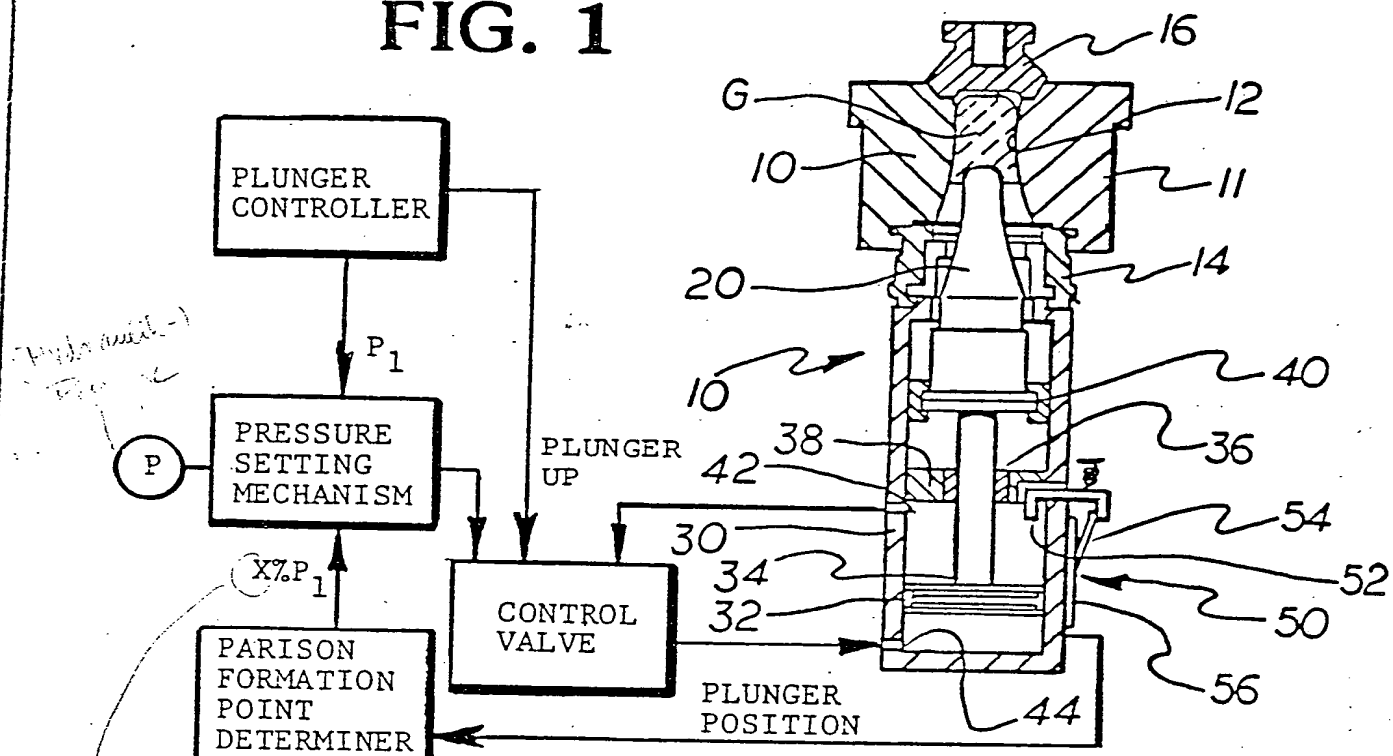
means (Parison Formation Point Determiner) for decreasing said selected pressure by a predetermined amount when said computer means determines that said plunger has been displaced to said parison formation point.

2. An individual section glass forming machine according to claim 1 comprising a plurality of parison mould assemblies (10).

3. An individual section glass forming machine according to claim 1, wherein said determining means includes means (60) for inputting said predetermined amount.

4. An individual section glass forming machine according to claim 3, wherein said sensing means comprises a linear potentiometer (50).

FIG. 1


PLUNGER CONTROLLER
P_1
PRESSURE SETTING MECHANISM
P
PLUNGER UP
CONTROL VALVE
$X\%P_1$
PARISON FORMATION POINT DETERMINER
60
PLUNGER POSITION
16
G
12
10
11
20
14
10
40
38
36
42
54
30
34
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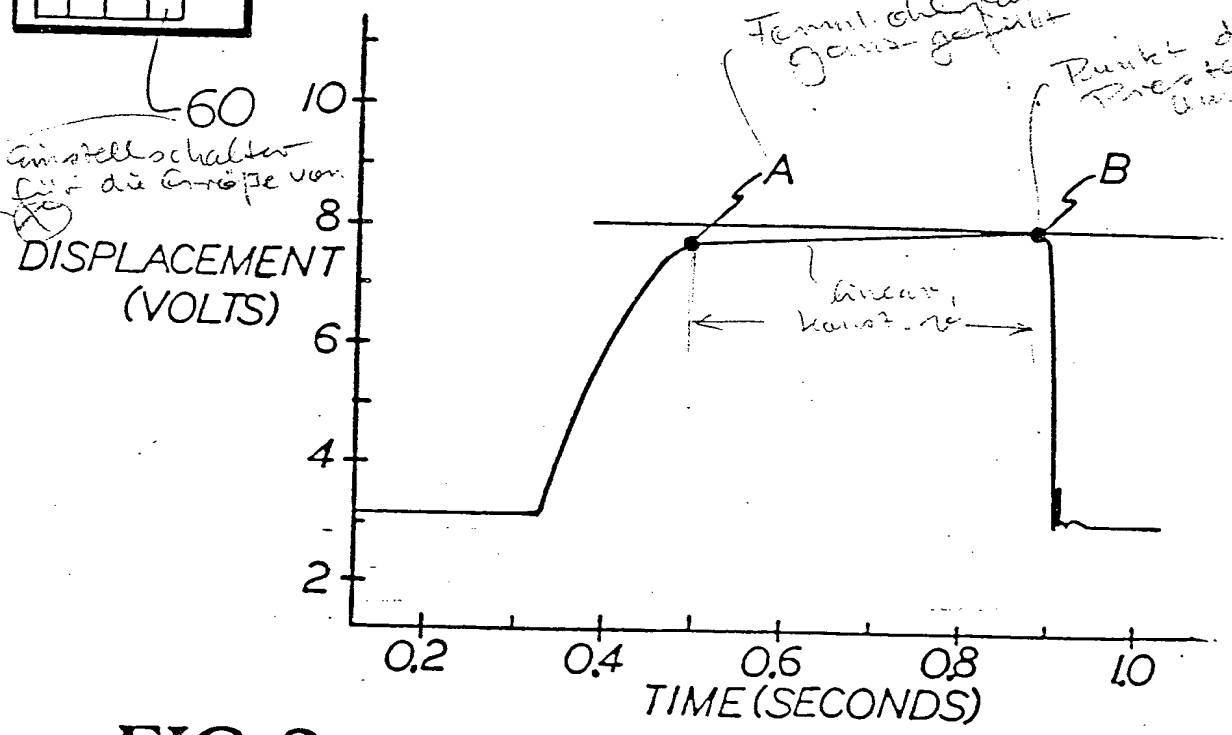
10
8
6
4
2
DISPLACEMENT (VOLTS)
A
B
0.2
0.4
0.6
0.8
1.0
TIME (SECONDS)

FIG. 2